Claims

We claim:

1. A tensioner comprising:

an electric actuator;

a force imparting member engaged with a lever arm;

a pulley journalled to the lever arm, the pulley engagable with a belt;

the force imparting member engaged with the electric actuator whereby the force imparting member is axially moveable by the electric actuator;

a load sensor coaxially engaged with the force imparting member, the load sensor detecting and transmitting a load signal to a controller; and

the controller using the load signal to control a force imparting member position.

2. The tensioner as in claim 1, wherein:

the force imparting member comprises a lead screw;

the lead screw rotatably engaged with a threaded collar.

3. The tensioner as in claim 1, wherein the electric actuator comprises an electric motor.

4. The tensioner as in claim 1, wherein the force imparting member is engaged with the electric actuator through a gear transmission.

5. The tensioner as in claim 1, wherein:

the load sensor further comprises a bore, the load sensor coaxially engaged with the force imparting member through the bore.

6. The tensioner as in claim 1, wherein the lever arm is pivotally engaged with a mounting surface.

7. A system for adjusting a tension of an endless belt comprising:

a tensioner having a toroid load sensor and a pulley journalled to a lever arm, the pulley in contact with an endless belt for applying a belt load to the endless belt;

the toroid load sensor detecting a belt load and transmitting a belt load signal to a controller; and

the controller using the belt load signal to select a pulley position for a belt load.

8. The system as in claim 7, wherein the tensioner further comprises:

an axially moveable member moveable by an electric actuator;

the lever arm engaged with the axially moveable member; and

the toroid load sensor coaxially engaged with the axially moveable member.

9. The system as in claim 8, wherein:

the electric actuator further comprises an electric motor, the electric motor engaged with the axially moveable member through a gear reduction transmission.

10. A method of controlling a belt load comprising the steps of:

engaging a belt with a pulley, the pulley journalled to a pivoting lever arm;

positioning the lever arm for a belt load;

using a toroid load cell to detect a belt load;

selecting a belt load value corresponding to a desired belt load;

comparing the belt load to the belt load value;

determining a new lever arm position based upon said belt load value; and

moving the lever arm to the new lever arm position to set the belt load to the belt load value.

11. The method as in claim 10 comprising:

detecting an engine parameter; and

selecting a belt load value with respect to the engine parameter.

12. A method of tensioning a belt comprising the steps of:

engaging a tensioner having a toroid load sensor with a belt;

adjusting the tensioner position to impart a belt load to the belt;

detecting the belt load with the toroid load sensor;

comparing the detected belt load with a desired belt load; and

adjusting the tensioner position with a controller until the detected belt load is substantially equal to the desired belt load.

13. The method as in claim 12 comprising the steps of:

selecting the desired belt load with respect to an engine operating parameter.

14. The method as in claim 13 comprising the step of:

selecting the desired belt load with respect to an engine operating speed.

15. The method as in claim 13 comprising the step of:

detecting an engine operating temperature;

selecting the desired belt load with respect to the engine operating temperature.

16. The method as in claim 12 comprising the step of selecting the desired belt load from a look up table.

17. The method as in claim 15 comprising the step of storing an engine temperature history in a controller memory.

18. The method as in claim 12 comprising the steps of:

using a reference tooth on the belt;

detecting each passage of the reference tooth with a sensor to determine cumulative belt cycles;

storing the cumulative belt cycles in a memory for analysis of a belt fatigue condition; and

informing a user.

19. A method of computing a belt modulus comprising the steps of:

engaging a tensioner having a load sensor with a belt;

adjusting the tensioner to a first position (P1) to impart a first belt load (L1) to the belt;

detecting the first belt load (L1) with the load sensor;

adjusting the tensioner to a second position (P2) to impart a second belt load (L2) to the belt;

detecting the second belt load (L2) with the load sensor; and

computing a belt modulus using (L1), (L2), (P1), (P2).

20. The method as in claim 19 further comprising the steps of:

storing the calculated belt modulus values in a controller memory;

comparing the calculated belt modulus values to identify a belt modulus trend; and

informing a user.

21. The method as in claim 19 comprising the steps of:

using a first limit switch to detect the first position (P1); and

using a second limit switch to detect the second position (P2).

22. The method as in claim 19 comprising the steps of:

adjusting the tensioner by driving the tensioner with a fixed duty cycle for a first duration to position (P1); and

adjusting the tensioner by driving the tensioner with a fixed duty cycle for a second duration to position (P2).

23. A method of computing a belt modulus comprising the steps of:

engaging a tensioner having a load sensor with a belt;

adjusting the tensioner to impart a first belt load (L1);

detecting the first belt position (P1) with the limit switch;

adjusting the tensioner to impart a second belt load (L2);

detecting the second belt position (P2) with the limit switch; and

computing a belt modulus using (L1), (L2), (P1), (P2).

24. The method as in claim 23 further comprising the steps of:

storing the calculated belt modulus values in a controller memory;

comparing the calculated belt modulus values to identify a belt modulus trend; and

informing a user.

25. A tensioner comprising:

an electric actuator;

a lead screw engaged with a lever arm;

a pulley engagable with a belt, the pulley journalled to the lever arm;

the lead screw engaged with the electric actuator whereby the lead screw is moveable by the electric actuator;

a load sensor coaxially engaged with the lead screw, the load sensor transmitting a load signal to a controller; and

the controller using the load signal to control a lead screw position.

26. The tensioner as in claim 25, wherein the electric actuator comprises an electric motor.

27. The tensioner as in claim 25, wherein the lead screw is engaged with the electric actuator by a gear transmission.

28. The tensioner as in claim 25, wherein:

the load sensor comprises a toroid load cell having a bore;

the toroid load cell coaxially engaged with the lead screw though the bore.

29. The tensioner as in claim 25, wherein the lever arm is pivotally engaged with a mounting surface.

30. The tensioner as in claim 25, wherein the lead screw is rotatably engaged with a collar.